

# Sample Proficiency Test exercise

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February 10, 2006

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#### **Sample Proficiency Test Exercise**

The current format of the OPCW proficiency tests has multiple sets of 2 samples sent to an analysis laboratory. In each sample set, one is identified as a sample, the other as a blank. This method of conducting proficiency tests differs from how an OPCW designated laboratory would receive authentic samples (a set of three containers, each not identified, consisting of the authentic sample, a control sample, and a blank sample).

This exercise was designed to test the reporting if the proficiency tests were to be conducted. As such, this is not an official OPCW proficiency test, and the attached report is one method by which LLNL might report their analyses under a more realistic testing scheme. Therefore, the title on the report "Report of the Umpteenth Official OPCW Proficiency Test" is meaningless, and provides a bit of whimsy for the analyses and readers of the report.

H. Gregg

A. Alcaraz

C. Koester



# ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

# Report of the Umpteenth Official OPCW Proficiency Test

Laboratory code: <u>05</u>

Total number of pages: 44<sup>1</sup>

<sup>&</sup>lt;sup>1</sup> Total number of pages including cover page and all attachments

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#### **SUMMARY: PARTICIPATING LABORATORY**

1. Participating laboratory

1. I al delpating laborato	/* J
Laboratory code	05
Name of the laboratory/institute participating in the test	Lawrence Livermore National Laboratory
Contact person	Mr. Armando Alcaraz
Address	PO Box 808, M/S L-178 7000 East Avenue Livermore, CA 94551
Telephone number	925-423-6889
Fax number	925-423-9014
Email address	Alcaraz1@llnl.gov

#### 2. Analysts and authentication

	Name	Title	Pages*	Date**	Signature**
1	Mr. Armando Alcaraz	Principal Investigator	All	Feb. 3, 2006	Camanda alcare
2	Dr. Hugh Gregg	Co-PI, Senior Chemist	All	Feb. 3, 2006	they any
3	Dr. Carolyn Koester	Research Scientist	Prep & GC/MS	Feb. 3, 2006	Carolin Kvest
4	Dr. Phil Pagoria	Research Scientist	Synthesis	Feb. 3, 2006	Phile Pagerie
5	Dr. Robert Maxwell	Research Scientist	NMR analysis	Feb. 3, 2006	Keles & M
6	Ms. Tuijauna Mitchell-Hall	QA Manager	QA/QC	Feb. 3, 2006	Dinjaun Fritchell-Har
7					
8					
9					

<sup>\*</sup> Page numbers defining the responsibility area of the analyst;
\*\* Date and signature of the responsible analyst;

# SUMMARY: QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

Accreditation accepted: Year 2001 Accreditation body: American Association for Laboratory Accreditation Scope of accreditation: Chemical
Accreditation planned/pending: Target year Accreditation body: Scope of accreditation:
☐ Not accredited.
2. Quality system (tick where applicable)
<ul> <li>Described in a Quality Assurance Manual/Handbook. Quality system in accordance with:</li> <li>☐ ISO 900</li></ul>
☐ No quality system. Please, fill in question number 3.
<b>3. QA/QC Summary</b> (Summary of the applied quality assurance and quality control (QA/QC) procedures concerning sample preparation, calibration, and analysis. Requested only from laboratories without a quality system).



THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

#### **ACCREDITED LABORATORY**

A2LA has accredited

#### LAWRENCE LIVERMORE NATIONAL LABORATORY Livermore, CA

for technical competence in the field of

#### **Chemical Testing**

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing.

Presented this 12th day of April 2004.



President
For the Accreditation Council
Certificate Number 1914-01
Valid to February 28, 2006

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Chemical Scope of Accreditation.



#### **American Association for Laboratory Accreditation**

#### SCOPE OF ACCREDITATION TO ISO/IEC 17025-1999

LAWRENCE LIVERMORE NATIONAL LABORATORY FORENSIC SCIENCE CENTER - OPCW PROJECT 7000 East Avenue Mailstop L-178 Livermore, CA 94550 Phone: 925 423 6889 Armando Alcaraz

#### CHEMICAL

Valid To: February 28, 2006 Certificate Number: 1914-01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following types of Qualitative Tests for Chemicals related to Chemical Warfare Convention (CWC) in unknown samples:

Sample Preparation	BB-SP5, BB-SP6, BB-SP8, BB-SP9,
	II CDI II CD2 II CD2 II CD4

Test	<u>Procedures</u>
Spectroscopy Nuclear magnetic resonance	BB-NMR1

LL-CE1 Capillary zone electrophoresis / UV detection

Gas chromatography / Fourier Transform BB-IR1 Infrared Spectrometry

Gas chromatography / Element Specific Detectors BB-GC1

Gas chromatography / Mass Spectrometry BB-MS1

Liquid chromatography / Atmospheric pressure Chemical Ionization / Mass Spectrometry BB-MS4

Liquid Chromatography / Electrospray Ionization Mass Spectrometry LL-MS1

Chain of Custody for Laboratory LL-CC1

Work Instructions for the Preparation of Test Samples QDOC/LAB/WI/PT2

for OPCW Proficiency Tests (Minus Section 11 Confirmation)

(A2LA Cert. No. 1914-01) Revised 04/15/2004





#### **OPCW**

Page no.

#### SUMMARY: NAMES AND STRUCTURES OF ALL REPORTED CHEMICALS

**Laboratory code: 05** 

Sam.	Chem. no*	Chemical name	Chemical Abstract number	Chemical Structure	Molecular formula	Schedule number	Comments**
O1	1	Diethyl methylphosphonate	683-08-9	0=0_/	$C_5H_{13}O_3P$	2.B.04	
O1	2	Dicyclohexyl methylphosphonate	7040-53-1	O-P-O-	$C_{13}H_{25}O_3P$	2.B.04	
O2	3	Diisopropyl methylphosphonate	1445-75-6	O = P - O - \	C <sub>7</sub> H <sub>17</sub> O <sub>3</sub> P	2.B.04	
O2	4	Diisopropyl ethylphosphonate	1067-69-2	O=P-O	C <sub>8</sub> H <sub>19</sub> O <sub>3</sub> P	2.B.04	
О3		No scheduled compounds					

Chemical number defined by the participating laboratory and used throughout the report for the reported chemical.

Note: There must be an unbroken chain of evidence linking each reported chemical to the original sample from which an aliquot was prepared and analyzed for the identification of this chemical.

Explanation for the reporting of non-scheduled compounds, details can be added in the comment section of the report.

# **SUMMARY: ANALYTICAL TECHNIQUES**

Laboratory code: <u>05</u> Sample code(s): <u>01/05</u>

Chemical	Chemical	Chemical	Analytical	Method	Aliquot name
number*	name	analysed as		page no.	_
1	Diethyl methylphosphonate	original chemical	GC/MS-EI	12	CW-1-159-1-O1
		methylated	GC/MS-CI	15	CW-1-159-1-O1
		silylated	GC/dFPD	18	CW-1-159-1-O1
		other:			
2	Dicyclohexyl methylphosphonate	original chemical	GC/MS-EI	20	CW-1-159-1-O1
		methylated	GC/MS-CI	23	CW-1-159-1-O1
		silylated	GC/dFPD	26	CW-1-159-1-O1
		other:			
		original chemical			
		methylated			
		silylated			
		other:			
		original chemical			
		methylated			
		silylated			
		other:			

<sup>\*</sup> Chemical number defined by the participating laboratory (see Summary: Names and Structures of All Reported Chemical);

#### **OPCW**

Page no.

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# **SUMMARY: ANALYTICAL TECHNIQUES**

Laboratory code: <u>05</u> Sample code(s): <u>O2/05</u>

Chemical	Chemical name	Chemical	Analytical	Method	Aliquot name
number*		analysed as	technique	page no.	
3	Diisopropyl methylphosphonate	original chemical	GC/MS-EI	28	CW-1-159-2-O2
		methylated	GC/MS-CI	31	CW-1-159-2-O2
		silylated	GC/dFPD	34	CW-1-159-2-O2
		other:			
4	Diisopropyl ethylphosphonate	original chemical	GC/MS-EI	36	CW-1-159-2-O2
		methylated	GC/MS-CI	39	CW-1-159-2-O2
		silylated	GC/dFPD	42	CW-1-159-2-O2
		other:			
		original chemical			
		<u> </u>			
		silylated			
		other:			
		original chemical			
		methylated			
		silylated			
		other:			

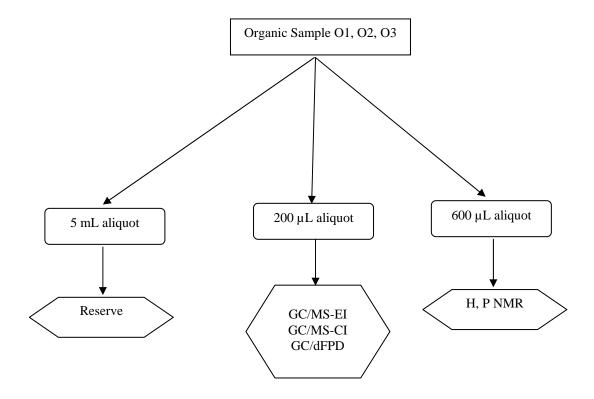
<sup>\*</sup> Chemical number defined by the participating laboratory (see Summary: Names and Structures of All Reported Chemical);

#### **SAMPLE PREPARATION DESCRIPTION**

<b>Laboratory code:</b>	05	Sample code(s):	O1/05, O2/05, O3/05

Sample/ Aliquot Code	Specification of Sample/ Type of Sample Preparation	Amount/ Volume	Sample Preparation Procedures	End Volume	Resulting Aliquot Code	Analytical Technique(s)
O1/05	Organic	0.2 mL	No sample workup.	200 μL	CW-1-159-1-O1	GC/MS-EI GC/MS-CI GC/dFPD
O2/05	None.	0.2 mL	No sample workup.	200 μL	CW-1-159-2-O2	GC/MS-EI GC/MS-CI GC/dFPD
O3/05	None.	0.2 mL	No sample workup.	200 μL	CW-1-159-3-O3	GC/MS-EI GC/MS-CI GC/dFPD

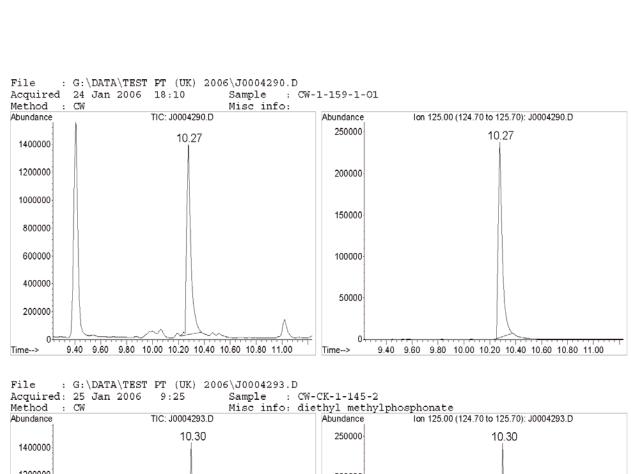
2. Additional information

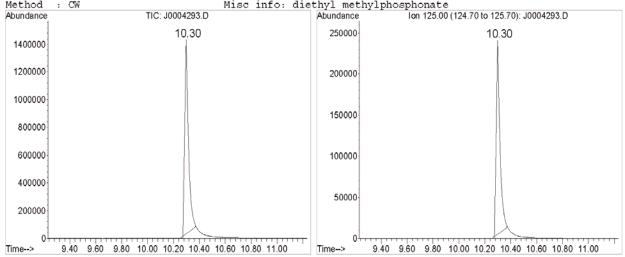


Note: This flowchart is for visualization only; see the preceding sample preparation description page for sample aliquot numbers

### GC-EI-MS TECHNIQUE METHOD AND ANALYSIS DESCRIPTION

Laboratory code: <u>05</u> S	ample code(s):	<u>O1/05</u>	Chem	ical number:	<u>1</u>
Aliquot codes:					
Sample: CW-1-159-1-O1					
ANALYSIS METHOD					
Instrument Manufacturer and Type:	Agilent 6890/	5973 GC/MSE	)		
Carrier gas:	⊠ He □	$N_2 \qquad \Box H_2$	Other:		
Flow rate:	□ ml/min ⊠ 32 cm/s				
Flow control:	☐ Constant Pressure ☐ Constant Flow				
Injection mode:					
Injector temperature:	250 °C				
Column brand/phase:	Agilent HP-5MS: (5%-Phenyl)-methylpolysiloxane				
Column Length x ID x	30 m x 0.25 mm x 0.25 μm				
Film thickness:					
GC temperature	40 °C (3 min), 8 °C/min, 300 °C (3 min)				
programme:					
Solvent delay time:	3 min	Scan ra		30-600 m/z	
Electron energy:	70 eV	Scan ti		0.7 s	
Ionisation polarity:	<ul><li>☐ Positive</li><li>☐ Negative</li></ul>	Mass re	esolution:	0.7 u	
<b>Comments:</b>					
IDENTIFICATION					
Compound identified as:	nd identified as:  ☐ Methyl ester derivative ☐ TBDMS (t-Butyldimethylsilyl) derivative ☐ TMS (Trimethylsilyl) derivative ☐ Other derivative:				
Retention parameter used for (peak) identification:		etention time (l can number	Rt)		
⊠ Compared to reference che	emical: Source	ce : Own	Synthesis		
☐ Compared to library spectr	rum: Source	ce : OCA	D (code: y  \text{Ow}	)	
☐ Not compared to reference	Inten	Intense ions in spectrum are explained; interpretation is			
chemical or library spectru		orted by the speed chemical(s):		ation derived from	n closely
Comments:					





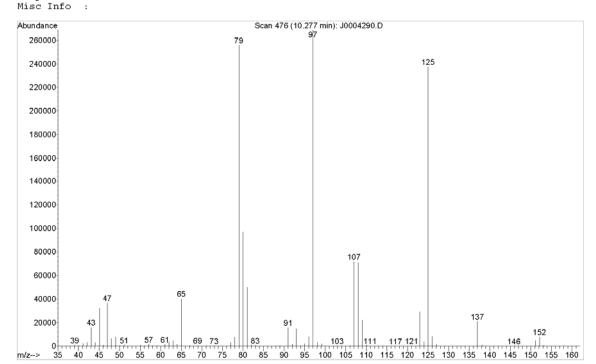
EI chromatograms supporting identification of compound 1; TIC on left; EIC (m/z 125) on right.

Top: Chromatograms of Organic sample, aliquot **CW-1-159-1-O1** from **O1/05**, retention time **10.27** 

min.

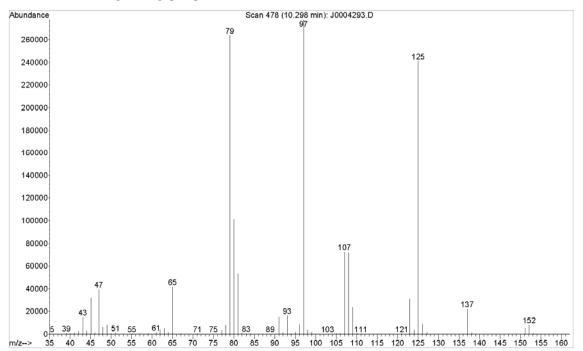
Bottom: Chromatograms of authentic reference standard of **Diethyl methylphosphonate**, retention time **10.30** min.

File :D:\DATA\TEST PT (UK) 2006\J0004290.D Acquired : 24 Jan 2006 18:10 using AcqMethod CW Sample Name: CW-1-159-1-O1



File :D:\DATA\TEST PT (UK) 2006\J0004293.D
Acquired : 25 Jan 2006 9:25 using AcqMethod CW
Sample Name: CW-CK-1-145-2

Misc Info : diethyl methylphosphonate



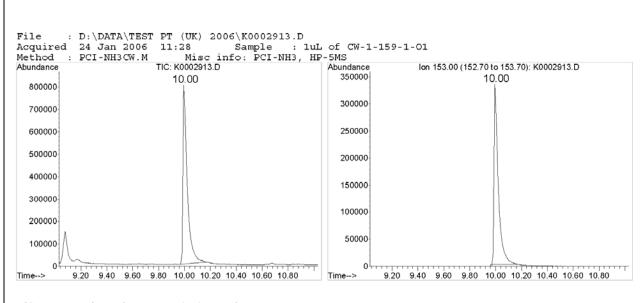
EI mass spectra of:

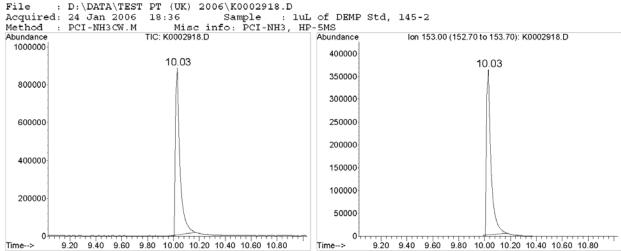
Top: Compound 1 in Organic sample O1/05, aliquot CW-1-159-1-O1

Bottom: Authentic reference standard of **Diethyl methylphosphonate** corresponding to compound **1** (MW: **152**)

# GC-CI-MS TECHNIQUE METHOD AND ANALYSIS DESCRIPTION

Laboratory code: <u>05</u> S	ample code(s): <u>(</u>	<u>01/05</u> Chem	ical number: 1		
Aliquot codes:					
Sample: CW-1-159-1-O1					
ANALYSIS METHOD					
Instrument Manufacturer	Agilent 6890/5973	3 GC/MSD			
and Type:					
Carrier gas:	$\boxtimes$ He $\square$ N <sub>2</sub>	$\square$ H <sub>2</sub> $\square$ Other:			
Flow rate:	$\square$ ml/min $\boxtimes$ 32 cm/s				
Flow control:	☐ Constant Press	ure 🛛 Constant F	low		
Injection mode:	$\square$ Split $\rightarrow$ Split ratio = $\square$ On Column				
	$\boxtimes$ Splitless $\rightarrow$ Splitless time = 0.75 min.				
Injector temperature:	250 °C				
Column brand/phase:	Agilent HP-5MS: (5%-Phenyl)-methylpolysiloxane				
Column Length x ID x	30 m x 0.25 mm x 0.25 μm				
Film thickness:					
GC temperature	40 °C (3 min), 8 °C	C/min, 300 °C (3 min)			
programme:					
Reaction gas:	☐ Methane ☐ 1	Isobutane 🛛 Ammo	nia		
Solvent delay time:	3 min	Scan range:	55-600 m/z		
Electron energy:	235 eV	Scan time:	0.7 s		
Ionisation polarity:	<ul><li>☑ Positive</li><li>☑ Negative</li></ul>	Mass resolution:	0.7 u		
<b>Comments:</b>					
IDENTIFICATION					
Compound identified as:	<ul> <li>☑ Original compound</li> <li>☐ Methyl ester derivative</li> <li>☐ TBDMS (t-Butyldimethylsilyl) derivative</li> <li>☐ TMS (Trimethylsilyl) derivative</li> <li>☐ Other derivative:</li> </ul>				
Retention parameter used for		ion time (Rt)			
(peak) identification:	☐ Scan n	umber			
	emical: Source:	☐ Own Synthesis			
☐ Not compared to reference	Intense io	ns in spectrum are expl	ained		
chemical or library spectru	m: RT GC/I	MS-EI RT GO	C/MS-CI		
Comments:					



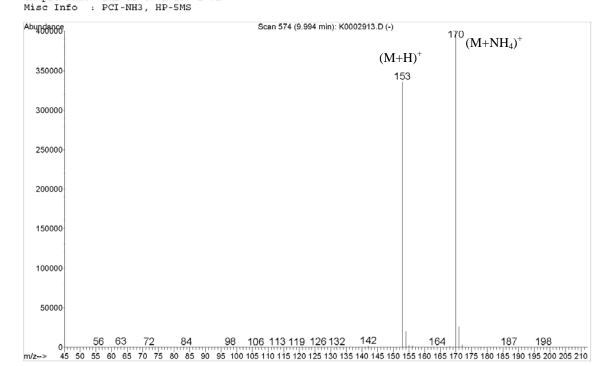


CI chromatograms supporting identification of compound 1; TIC on left; EIC (m/z 153) on right.

Top: Chromatograms of Organic sample, aliquot **CW-1-159-1-O1** from **O1/05**, retention time **10.00** min.

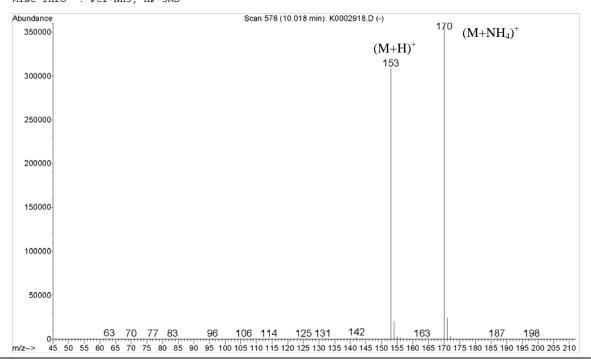
Bottom: Chromatograms of authentic reference standard of **Diethyl methylphosphonate**, retention time **10.03** min.

File :D:\DATA\TEST PT (UK) 2006\K0002913.D Acquired : 24 Jan 2006 11:28 Sample Name: 1uL of CW-1-159-1-01 using AcqMethod PCI-NH3CW.M



:D:\DATA\TEST PT (UK) 2006\K0002918.D

Acquired : 24 Jan 2006 18:36 using AcqMethod PCI-NH3CW.M Sample Name: 1uL of DEMP Std, 145-2 Misc Info : PCI-NH3, HP-5MS



CI mass spectrum of:

Compound 1 in Organic sample O1/05, aliquot CW-1-159-1-O1 Top:

Authentic reference standard of **Diethyl methylphosphonate** corresponding to compound **1** Bottom: (MW: 152)

# GAS CHROMATOGRAPHY TECHNIQUE METHOD AND ANALYSIS DESCRIPTION

Laboratory code: <u>05</u> S	Sample code(s):	O1/05	Chemical number: 1				
Aliquot codes:							
Sample: CW-1-159-1-O	1						
ANALYSIS METHOD	A 11 + 6000 GG	3 1 1 EDD					
Instrument Manufacturer	Agilent 6890 GO	dual FPD					
and Type:			☐ Other:				
Carrier gas:							
Flow rate:	☐ ml/min ☐ 32 cm/s ☐ Constant Pressure ☐ Constant Flow						
Flow control:	<del>-</del>		Constant Flow				
Injection mode:	$\square$ Split $\rightarrow$	1					
	$\boxtimes$ Splitless $\rightarrow$ Splitless time = 0.75 min.						
Injector temperature:	250 °C						
Column brand/phase:	Agilent HP-5MS: (5%-Phenyl)-methylpolysiloxane						
Column Length x ID x	30 m x 0.25 mm x 0.25 μm						
Film thickness:							
GC temperature	40 °C (3 min), 8 °C/min, 300 °C (3 min)						
programme:							
<b>Detector:</b>	$\square$ AED $\rightarrow$	Element(	s) =				
	☐ NPD		_				
	$\boxtimes$ FPD $\rightarrow$	⊠ P-mod	le  S-mode				
	Other:						
Comments:							
IDENTIFICATION							
Chemical identified as:	☐ Original Che	mical					
Chemical Identified as.	☐ Methyl ester						
			lsilyl) derivative				
	☐ TMS (Trimet	•	• /				
	Other derivat						
Retention parameter used	☐ Retention tim	ne (Rt)	Scan number				
for (peak) identification:		ic (Rt)	J Scan number				
<b>⊠</b> Compared to reference	Source of Refere	ence:	Own Synthesis				
chemical:	Source of Refere						
☐ Compared to library	Measured RI of	identified Cl	nemical =				
RI:	RI OCAD =		OCAD Code =				
Comments			COID COUC -				
Comments							

**OPCW** Page no. File : C:\DATA\TESTPT-1\FPD-0104.D
Acquired : 1/23/06 3:55:52 FM
Method name: CW.M
Sample Name: CW-1-159-1-01
Misc Info : OPCW sample FPD1 A, (C:\DATA\TESTPT~1\FPD-0104.D) 150 pA Compound: 1 10,395 35000 Sample: O1/05 CW-1-159-1-O1 Aliquot: 30000 Ret. time: 10.40 min. 25000 20000 GC/dFPD (phosphorous trace 15000 only) chromatogram of Organic sample. 10000 5000 10.5 1111.25 10.25 10.75 File : C:\DATA\TESTFT~1\FPD-0107.D
Acquired : 1/23/06 6:16:15 PM
Method name: CW.M
Sample Name: CW-CK-1-145-2
Misc Info : ~ 5 ng/uL diethyl methylphosphonate FPD1 A, (C:\DATA\TESTPT~1\FPD-0107.D) 150 pA 10.402 Compound: 1 35000 Sample: reference std. Ret. time: 10.40 min. 30000 25000 GC/dFPD (phosphorous trace 20000 only) chromatogram of 15000 authentic reference standard Diethyl methylphosphonate. 10000 5000

1111.25

min

10.5

10.75

10.25

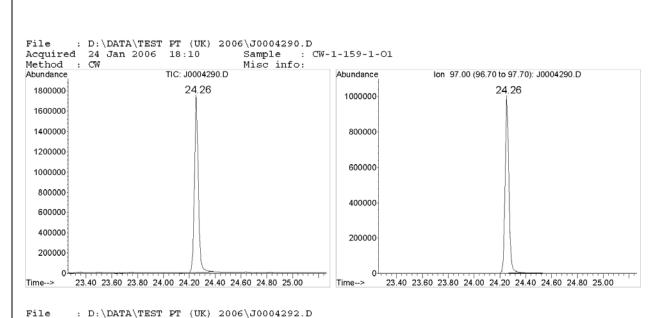
9.75

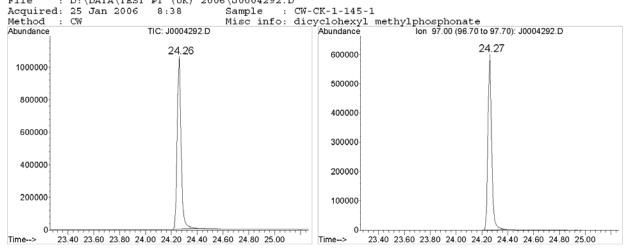
10

9.5

### GC-EI-MS TECHNIQUE METHOD AND ANALYSIS DESCRIPTION

Laboratory code: <u>05</u> S	ample co	ode(s): <u>O</u>	<u>1/05</u> C	hemical numb	per: <u>2</u>	
Aliquot codes:						
Sample: CW-1-159-1-O1						
ANALYSIS METHOD						
Instrument Manufacturer	Agilent	6890/5973	GC/MSD			
and Type:						
Carrier gas:	⊠ He	$\square$ N <sub>2</sub>		ther:		
Flow rate:		ml/min				
Flow control:	☐ Con	istant Pressu	re 🛛 Consta	ant Flow		
Injection mode:	☐ Spli 図 Spli		Split ratio = Splitless time = 0	<del></del>	Column	
Injector temperature:	250 °C		<u></u>	.,,		
Column brand/phase:		HP-5MS: (	5%-Phenyl)-meth	ylpolysiloxane	 ;	
Column Length x ID x		0.25 mm x (	• ′	- <u>y -p y</u>		
Film thickness:	о и и о до и и о до рии					
GC temperature	40 °C (	3 min), 8 °C	<sup>2</sup> /min, 300 °C (3 n	nin)		
programme:						
Solvent delay time:	3 min		Scan range:	30-600 n	n/z	
<b>Electron energy:</b>	70 eV		Scan time:	0.7 s		
Ionisation polarity:	⊠ Pos	itive	Mass resolution	n: 0.7 u		
	☐ Neg	gative				
<b>Comments:</b>						
IDENTIFICATION						
Compound identified as:			l compound			
			ester derivative			
			S (t-Butyldimethy		ve	
			rimethylsilyl) der	rivative		
		Other d				
Retention parameter used for	or	□ Retention	on time (Rt)			
(peak) identification:		☐ Scan nu	mber			
⊠ Compared to reference che	emical:	Source:	Own Synthesis	s 🖂 Comn	nercial	
Compared to library spectr		Source:	OCAD (code	: ) 🗌 N	IIST	
			☐ Wiley ☐	] Own   D	ther:	
☐ Not compared to reference			s in spectrum are	-	•	
chemical or library spectru	ım:		by the spectral inf	formation deriv	ed from closely	
		related che	mical(s):			
Comments:						

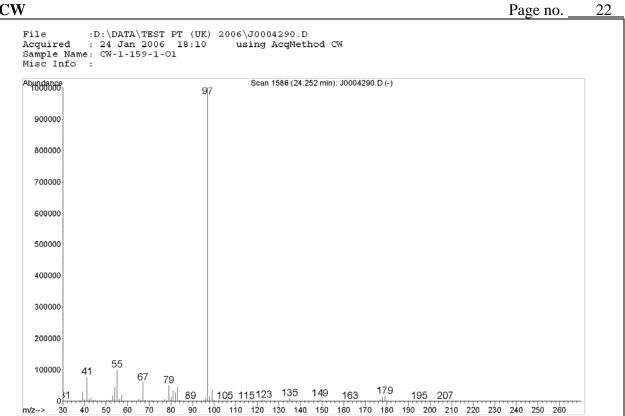




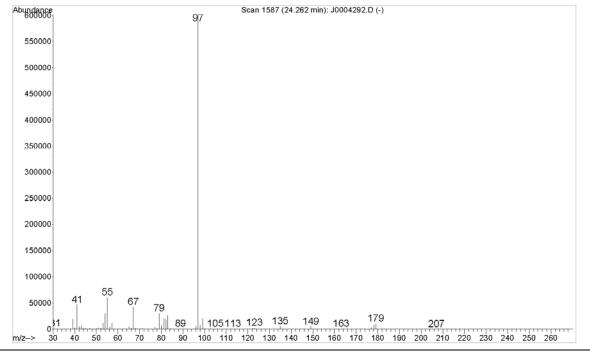
EI chromatograms supporting identification of compound 2; TIC on left; EIC (m/z 97) on right.

Top: Chromatograms of Organic sample, aliquot **CW-1-159-1-O1** from **O1/05**, retention time **24.26** 

Bottom: Chromatograms of authentic reference standard of **Dicyclohexyl methylphosphonate**, retention time **24.27** min.



Acquired : 25 Jan 2006
Sample Name: CW-CK-1-145-1
Mise Info : dicyclobarra :D:\DATA\TEST PT (UK) 2006\J0004292.D 8:38 using AcqMethod CW : dicyclohexyl methylphosphonate



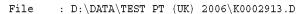
EI mass spectra of:

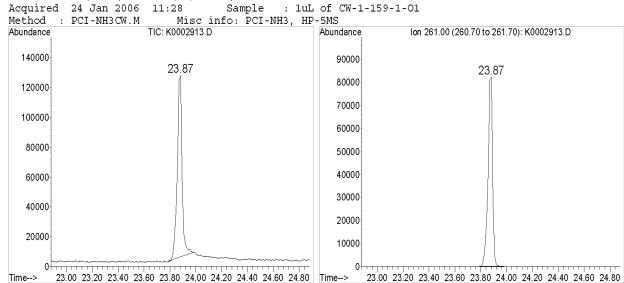
Compound 2 in Organic sample O1/05, aliquot CW-1-159-1-O1 Top:

Bottom: Authentic reference standard of Dicyclohexyl methylphosphonate corresponding to compound 2 (MW: 260)

# GC-CI-MS TECHNIQUE METHOD AND ANALYSIS DESCRIPTION

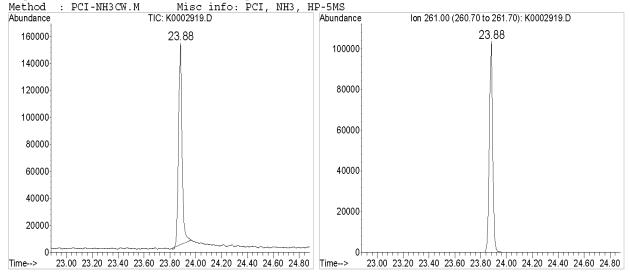
Laboratory code: <u>05</u> S	ample code	(s): <u>O</u>	1/05	Chem	ical number:	2
Aliquot codes:						
Sample: CW-1-159-1-O1						
ANALYSIS METHOD						
Instrument Manufacturer	Agilent 68	90/5973	GC/MSD			
and Type:						
Carrier gas:	⊠ He	$\square$ N <sub>2</sub>	$\square$ H <sub>2</sub>	Other:		
Flow rate:		ml/min	⊠ 32	2 cm/s		
Flow control:	☐ Consta	nt Pressu	re 🖂	Constant F	low	
Injection mode:	$\square$ Split $\rightarrow$ Split ratio = $\square$ On Column				nn	
	$\boxtimes$ Splitless $\rightarrow$ Splitless time = 0.75 min.					
Injector temperature:	250 °C					
Column brand/phase:	Agilent HP-5MS: (5%-Phenyl)-methylpolysiloxane					
Column Length x ID x	30 m x 0.25 mm x 0.25 μm					
Film thickness:						
GC temperature	40 °C (3 m	in), 8 °C	min, 300	°C (3 min)		
programme:						
Reaction gas:	☐ Methan	e 🔲 Is	sobutane	⊠ Ammo		
Solvent delay time:	3 min		Scan ran	_	55-600 m/z	
Electron energy:	235 eV		Scan tim		0.7 s	
Ionisation polarity:	<ul><li>☑ Positiv</li><li>☑ Negativ</li></ul>		Mass res	solution:	0.7 u	
<b>Comments:</b>						
IDENTIFICATION						
Compound identified as:  Retention parameter used for	<ul> <li>☑ Original compound</li> <li>☐ Methyl ester derivative</li> <li>☐ TBDMS (t-Butyldimethylsilyl) derivative</li> <li>☐ TMS (Trimethylsilyl) derivative</li> <li>☐ Other derivative:</li> <li>☑ Retention time (Rt)</li> </ul>					
(peak) identification:		Scan nu	,	-/		
	mical. Sc	ource :	Own Sy	znthecic		
<ul><li></li></ul>			•	um are expl		
chemical or library spectru	_	RT GC/M			Z/MS-CI	
Comments:	iiii.	111 00/14			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
Comments.						





File : D:\DATA\TEST PT (UK) 2006\K0002919.D

Acquired: 24 Jan 2006 19:24 Sample : 1uL of DCMP Std, 145-1



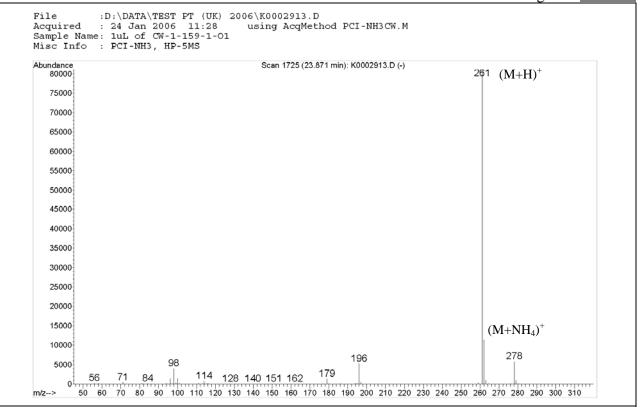
CI chromatograms supporting identification of compound 2; TIC on left; EIC (m/z 261) on right.

Top: Chromatograms of Organic sample, aliquot **CW-1-159-1-O1** from **O1/05**, retention time **23.87** 

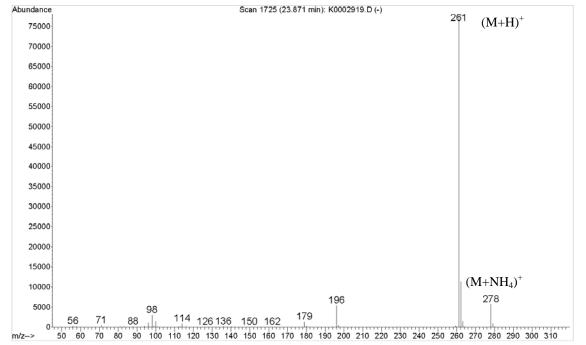
min.

Bottom: Chromatograms of authentic reference standard of **Dicyclohexyl methylphosphonate**, retention

time 23.88 min.







CI mass spectrum of:

Top: Compound 2 in Organic sample O1/05, aliquot CW-1-159-1-O1

Bottom: Authentic reference standard of **Dicyclohexyl methylphosphonate** corresponding to compound **2** (MW: **260**)

# GAS CHROMATOGRAPHY TECHNIQUE METHOD AND ANALYSIS DESCRIPTION

Laboratory code: <u>05</u> S	Sample code(s):	<u>O1/05</u>	Chemical number: $\underline{2}$					
Aliquot codes:								
Sample: CW-1-159-1-O2	1							
<u> </u>								
ANALYSIS METHOD								
Instrument Manufacturer	Agilent 6890 G	C dual FPD						
and Type:								
Carrier gas:	$\square$ He $\square$ N <sub>2</sub> $\square$ H <sub>2</sub> $\square$ Other:							
Flow rate:	ml/m		2 cm/s					
Flow control:	Constant Pre		Constant Flow					
Injection mode:	$\square$ Split $\rightarrow$ Split ratio =							
	$\boxtimes$ Splitless $\rightarrow$ Splitless time = 0.75 min.							
Injector temperature:	250 °C							
Column brand/phase:	Agilent HP-5MS: (5%-Phenyl)-methylpolysiloxane							
Column Length x ID x	30 m x 0.25 mm x 0.25 μm							
Film thickness:								
GC temperature	40 °C (3 min), 8 °C/min, 300 °C (3 min)							
programme:								
<b>Detector:</b>	$\square$ AED $\rightarrow$	Element(	s) =					
	☐ NPD							
	$\bowtie$ FPD $\rightarrow$	⊠ P-mod	le					
	Other:							
Comments:								
IDENTIFICATION								
Chemical identified as:	□ Original Che	mical						
Chemical luchtified as.	☐ Methyl ester							
			lsilyl) derivative					
	☐ TMS (Trimer		• .					
	Other derivation							
Retention parameter used	☐ Retention tin		l Scan number					
for (peak) identification:	Meterition un	ile (Kt)	J Scan number					
•	Source of Refer	anca:	Own Synthesis					
<b>⊠</b> Compared to reference chemical:	Source of Refer	ciice.	JOWN Synthesis					
☐ Compared to library	Measured RI of	identified Cl	nemical –					
RI:	RI OCAD =	→	OCAD Code =					
	KI OCAD –	$\rightarrow$	OCAD Code –					
Comments	1							

**OPCW** Page no. File : C:\DATA\TESTPT-1\FPD-0104.D
Acquired : 1/23/06 3:55:52 FM
Method name: CW.M
Sample Name: CW-1-159-1-01
Misc Info : OPCW sample FPD1 A, (C:\DATA\TESTPT~1\FPD-0104.D) 150 pA Compound: 2 16000 24.093 Sample: O1/05 14000 CW-1-159-1-O1 Aliquot: 12000 Ret. time: 24.09 min. 10000 8000 GC/dFPD (phosphorous trace 6000 only) chromatogram of Organic sample. 4000 2000 23.75 24.25 24255 File : C:\DATA\TESTPT~1\FFPD-0106.D
Acquired : 1/23/06 5:29:25 FM
Method name: CW.M
Sample Name: CW-CK-1-145-1
Misc Info : ~5 ng/L dicyclohexyl methylphosphonate FPD1 A, (C:\DATA\TESTPT~1\FPD-0106.D) Compound: 2 150 pA 24.096 14000 Sample: reference std. Ret. time: 24.10 min. 12000 10000 GC/dFPD (phosphorous trace 8000 only) chromatogram of 6000 authentic reference standard **Dicyclohexyl** 4000 methylphosphonate. 2000

23.25

23.5

23.75

24.25

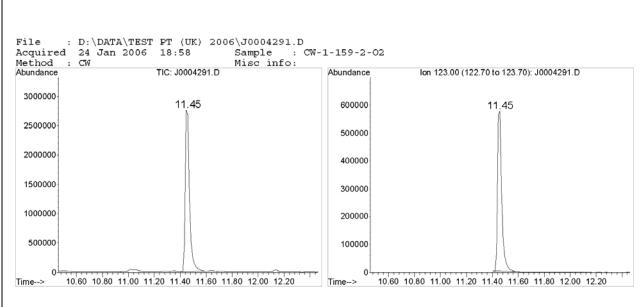
24.5

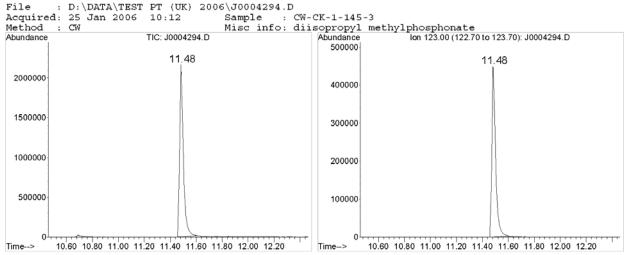
24255

min

### GC-EI-MS TECHNIQUE METHOD AND ANALYSIS DESCRIPTION

Laboratory code: <u>05</u> S	ample code(s):	<u>O2/05</u> CI	nemical number: 3		
Aliquot codes:					
Sample: CW-1-159-2-O2					
ANALYSIS METHOD					
Instrument Manufacturer and Type:	Agilent 6890/59'	73 GC/MSD			
Carrier gas:	$\square$ He $\square$ N <sub>2</sub> $\square$ H <sub>2</sub> $\square$ Other:				
Flow rate:	□ ml/mi	n			
Flow control:	☐ Constant Pres	ssure 🛛 Consta	nt Flow		
Injection mode:		1	☐ On Column 75 min.		
Injector temperature:	250 °C				
Column brand/phase:	Agilent HP-5MS: (5%-Phenyl)-methylpolysiloxane				
Column Length x ID x Film thickness:	30 m x 0.25 mm x 0.25 μm				
GC temperature	40 °C (3 min), 8 °C/min, 300 °C (3 min)				
programme:					
Solvent delay time:	3 min	Scan range:	30-600 m/z		
Electron energy:	70 eV	Scan time:	0.7 s		
Ionisation polarity:	<ul><li>☑ Positive</li><li>☑ Negative</li></ul>	Mass resolution	: 0.7 u		
<b>Comments:</b>					
IDENTIFICATION					
Compound identified as:	☐ Original compound ☐ Methyl ester derivative ☐ TBDMS (t-Butyldimethylsilyl) derivative ☐ TMS (Trimethylsilyl) derivative ☐ Other derivative:				
Retention parameter used for (peak) identification:		ntion time (Rt) number			
□ Compared to reference che	emical: Source:	Own Synthesis			
☐ Compared to library spectr	•				
☐ Not compared to reference chemical or library spectrum:  Intense ions in spectrum are explained; interpretation supported by the spectral information derived from claused chemical(s):					
Comments:					



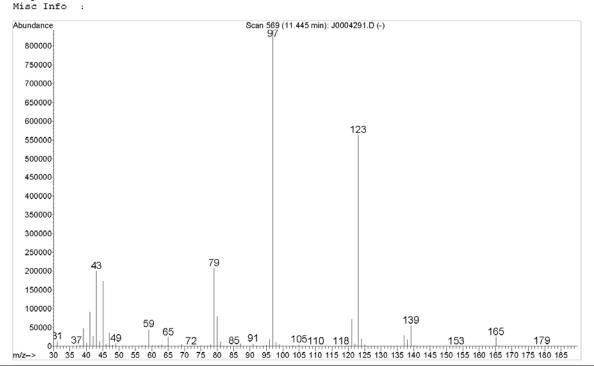


EI chromatograms supporting identification of compound 3; TIC on left; EIC (m/z 123) on right.

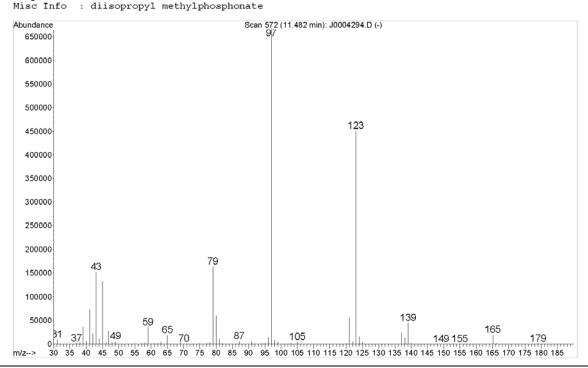
Top: Chromatograms of Organic sample, aliquot **CW-1-159-2-O2** from **O2/05**, retention time **11.45** min.

Bottom: Chromatograms of authentic reference standard of **Diisopropyl methylphosphonate**, retention time **11.48** min.

File :D:\DATA\TEST PT (UK) 2006\J0004291.D
Acquired : 24 Jan 2006 18:58 using AcqMethod CW
Sample Name: CW-1-159-2-02



File :D:\DATA\TEST PT (UK) 2006\J0004294.D
Acquired : 25 Jan 2006 10:12 using AcqMethod CW
Sample Name: CW-CK-1-145-3
Misc Info : diisopropyl methylphosphonate



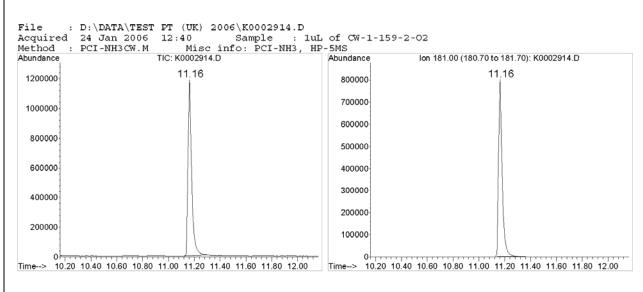
EI mass spectra of:

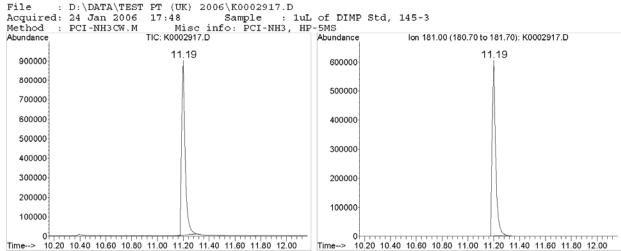
Top: Compound 3 in Organic sample O2/05, aliquot CW-1-159-2-O2

Bottom: Authentic reference standard of **Diisopropyl methylphosphonate** corresponding to compound 3 (MW: **180**)

### GC-CI-MS TECHNIQUE METHOD AND ANALYSIS DESCRIPTION

Laboratory code: <u>05</u> S	ample code(s):	<u>O2/05</u>	Chemical number:	3	
Aliquot codes:					
Sample: CW-1-159-2-O2					
ANALYSIS METHOD					
Instrument Manufacturer	Agilent 6890/597	3 GC/MSD			
and Type:					
Carrier gas:	$\square$ He $\square$ N <sub>2</sub>		ther:		
Flow rate:	□ ml/min				
Flow control:	☐ Constant Pres	sure 🛛 Const	ant Flow		
Injection mode:	$\square$ Split $\rightarrow$	Split ratio =	On Column	l	
	$\boxtimes$ Splitless $\rightarrow$	Splitless time = 0	).75 min.		
Injector temperature:	250 °C				
Column brand/phase:	Agilent HP-5MS: (5%-Phenyl)-methylpolysiloxane				
Column Length x ID x	30 m x 0.25 mm x 0.25 μm				
Film thickness:					
GC temperature	40 °C (3 min), 8 °C	°C/min, 300 °C (3 1	min)		
programme:					
Reaction gas:	☐ Methane ☐	Isobutane $\boxtimes A$	mmonia		
Solvent delay time:	3 min	Scan range:	55-600 m/z		
Electron energy:	235 eV	Scan time:	0.7 s		
Ionisation polarity:	<ul><li>☑ Positive</li><li>☑ Negative</li></ul>	Mass resolutio	<b>n:</b> 0.7 u		
Comments:					
IDENTIFICATION	<u> </u>				
Compound identified as:	<ul> <li>☑ Original compound</li> <li>☐ Methyl ester derivative</li> <li>☐ TBDMS (t-Butyldimethylsilyl) derivative</li> <li>☐ TMS (Trimethylsilyl) derivative</li> <li>☐ Other derivative:</li> </ul>				
Retention parameter used for		tion time (Rt)			
(peak) identification:	☐ Scan	number			
☐ Compared to reference che	emical: Source:	Own Synthesi	s   Commercial		
☐ Not compared to reference		ons in spectrum are			
chemical or library spectru	m: RT GC	/MS-EI I	RT GC/MS-CI		
Comments:					





CI chromatograms supporting identification of compound 3; TIC on left; EIC (m/z 181) on right.

Top: Chromatograms of Organic sample, aliquot **CW-1-159-2-O2** from **O2/05**, retention time **11.16** min.

Bottom: Chromatograms of authentic reference standard of **Diisopropyl methylphosphonate**, retention time **11.19** min.

114 123 131 139 148 <sup>156</sup>

150 160

170

180

100 110 120 130 140

224

220 230

238

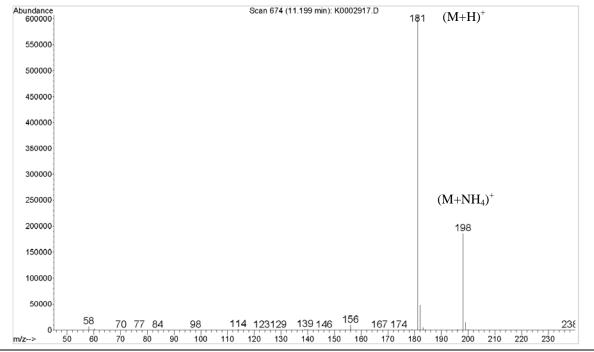
File :D:\DATA\TEST PT (UK) 2006\K0002917.D
Acquired : 24 Jan 2006 17:48 using AcqMethod PCI-NH3CW.M
Sample Name: 1uL of DIMP Std, 145-3
Misc Info : PCI-NH3, HP-5MS

102

87

90

75



CI mass spectrum of:

100000

50000

58

Top: Compound 3 in Organic sample O2/05, aliquot CW-1-159-2-O2

Bottom: Authentic reference standard of **Diisopropyl methylphosphonate** corresponding to compound **3** (MW: **180**)

OPCW Page no. <u>34</u>

# GAS CHROMATOGRAPHY TECHNIQUE METHOD AND ANALYSIS DESCRIPTION

Laboratory code: <u>05</u> S	Sample code(s):	<u>O2/05</u>	Chemical	number: <u>3</u>				
Aliquot codes:								
Sample: CW-1-159-2-O2	2							
<u> </u>								
ANALYSIS METHOD								
Instrument Manufacturer	Agilent 6890 G	C dual FPD						
and Type:								
Carrier gas:	$\square$ He $\square$ N <sub>2</sub> $\square$ H <sub>2</sub> $\square$ Other:							
Flow rate:	ļ <b>-</b>	☐ ml/min ⊠ 32 cm/s						
Flow control:	☐ Constant Pressure ☐ Constant Flow							
Injection mode:	$\square$ Split $\rightarrow$ Split ratio =							
	$\boxtimes$ Splitless $\rightarrow$ Splitless time = 0.75 min.							
Injector temperature:	250 °C							
Column brand/phase:	Agilent HP-5MS: (5%-Phenyl)-methylpolysiloxane							
Column Length x ID x	30 m x 0.25 mm x 0.25 μm							
Film thickness:								
GC temperature	40 °C (3 min), 8 °C/min, 300 °C (3 min)							
programme:								
<b>Detector:</b>	$\square$ AED $\rightarrow$	Element(	s) =					
	☐ NPD							
	$\boxtimes$ FPD $\rightarrow$	⊠ P-mod	le	le				
	Other:							
Comments:								
IDENTIFICATION								
Chemical identified as:	□ Original Che	mical						
Chemical luchtified as.	☐ Methyl ester							
			lsilyl) derivative					
	☐ TMS (Trimer	•	• '					
	Other derivation		.,					
Retention parameter used	⊠ Retention tin		Scan number					
for (peak) identification:	Material and	ic (IXI)	j Scali Hullioti					
<b>⊠</b> Compared to reference	Source of Refer	anca: 🗆 O	Synthesis					
chemical:	Source of Kelen	chee. $\square$ Owl	1 23Huiesis	M Commercial				
☐ Compared to library	Measured RI of	identified Cl	nemical –					
RI:	RI OCAD =	→	OCAD Code =					
Comments	M OCAD -	7	OCAD Code –					
Comments								

**OPCW** Page no. File : C:\DATA\TESTPT-1\FPD-0105.D
Acquired : 1/23/06 4:42:39 FM
Method name: CW.M
Sample Name: CW-1-159-2-02
Misc Info : OPCW sample FPD1 A, (C:\DATA\TESTPT~1\FPD-0105.D) 150 pA 11.539 Compound: 3 45000 Sample: O2/0540000 Aliquot: CW-1-159-2-O2 35000 Ret. time: 11.54 min. 30000 25000 GC/dFPD (phosphorous trace 20000 only) chromatogram of 15000 Organic sample. 10000 5000 11.25 1122255 File : C:\DATA\TESTFT~1\FFD-0108.D
Acquired : 1/23/06 7:03:01 PM
Method name: CW.M
Sample Name: CW-CK-1-145-3
Misc Info : ~ 5 ng/uL diisopropyl methylphosphonate FPD1 A, (C:\DATA\TESTPT~1\FPD-0108.D) Compound: 3 150 pA 11.558 Sample: reference std. 35000 Ret. time: 11.56 min. 30000 25000 GC/dFPD (phosphorous trace 20000 only) chromatogram of authentic reference standard 15000 Diisopropyl 10000 methylphosphonate. 5000

11.5

11.75

12

1122255

min

0 10.5

10.75

11

11.25

### GC-EI-MS TECHNIQUE METHOD AND ANALYSIS DESCRIPTION

**Chemical number:** 

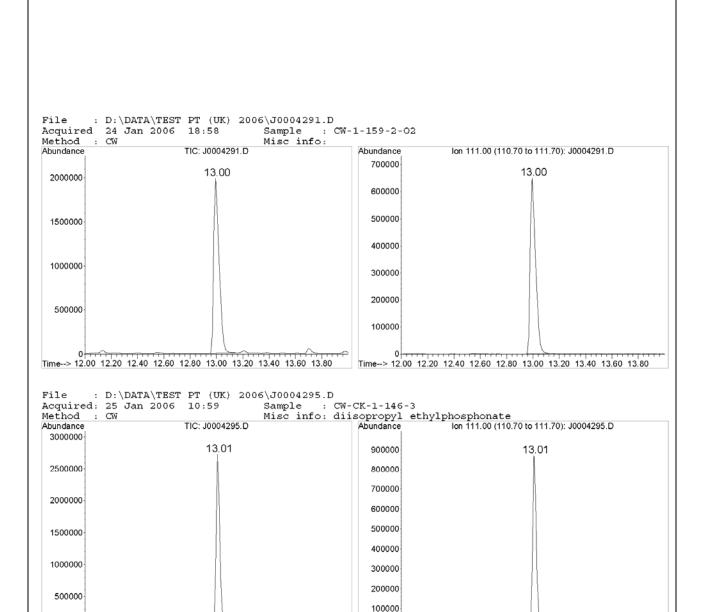
4

Sample code(s): O2/05

Laboratory code: <u>05</u>

A3. 4 3				
Aliquot codes:				
Sample:   CW-1-159-2-O2				
ANALYSIS METHOD				
Instrument Manufacturer	Agilent	t 6890/5973	GC/MSD	
and Type:				
Carrier gas:	⊠ He	$\square$ N <sub>2</sub>	$\square$ H <sub>2</sub> $\square$ Other:	
Flow rate:		ml/min		
Flow control:	☐ Cor	nstant Pressu	re 🛛 Constant Fl	low
Injection mode:		it $\rightarrow$	Split ratio =	On Column
	$\boxtimes$ Splitless $\rightarrow$ Splitless time = 0.75 min.			
Injector temperature:	250 °C			
Column brand/phase:	Agilent HP-5MS: (5%-Phenyl)-methylpolysiloxane			
Column Length x ID x	30 m x 0.25 mm x 0.25 μm			
Film thickness:				
GC temperature	40 °C (3 min), 8 °C/min, 300 °C (3 min)			
programme:				
Solvent delay time:	3 min		Scan range:	30-600 m/z
<b>Electron energy:</b>	70 eV		Scan time:	0.7 s
Ionisation polarity:	⊠ Pos	sitive	Mass resolution:	0.7 u
	☐ Neg	gative		
<b>Comments:</b>				
IDENTIFICATION				
Compound identified as:		□ Original	compound	
_		_	ester derivative	
		_	S (t-Butyldimethylsilyl	) derivative
		☐ TMS (T	rimethylsilyl) derivativ	ve
		☐ Other de	erivative:	
Retention parameter used for	or	⊠ Retentio	on time (Rt)	
(peak) identification:		Scan nu	` '	
Compared to reference che	mical:	Source:	☑ Own Synthesis	☐ Commercial
☐ Compared to library spectr	um:	Source:	OCAD (code:	) NIST
	☐ Wiley ☐ Own ☐ Other:			
☐ Not compared to reference				ained; interpretation is
chemical or library spectru	m:		•	ation derived from closely
	related chemical(s):			
Comments:				

**OPCW** Page no. <u>37</u>



EI chromatograms supporting identification of compound 4; TIC on left; EIC (m/z 111) on right.

Time--> 12.00 12.20 12.40 12.60 12.80 13.00 13.20 13.40 13.60 13.80

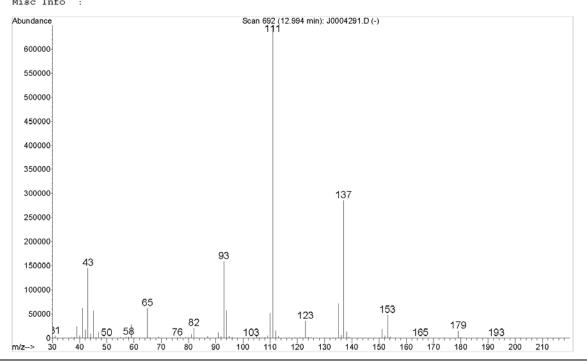
Top: Chromatograms of Organic sample, aliquot **CW-1-159-2-O2** from **O2/05**, retention time **13.00** min.

Bottom: Chromatograms of authentic reference standard of **Diisopropyl ethylphosphonate**, retention time **13.01** min.

Time-> 12.00 12.20 12.40 12.60 12.80 13.00 13.20 13.40 13.60 13.80

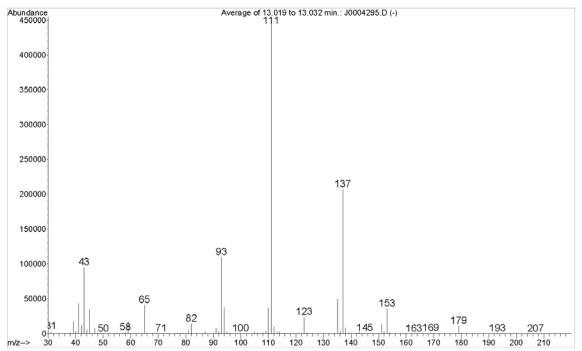
**OPCW** 38 Page no.

File :D:\DATA\TEST PT (UK) 2006\J0004291.D
Acquired : 24 Jan 2006 18:58 using AcqMeth
Sample Name: CW-1-159-2-02
Misc Info : using AcqMethod CW



:D:\DATA\TEST PT (UK) 2006\J0004295.D File Acquired : 25 Jan 2006 10:59 Sample Name: CW-CK-1-146-3 using AcqMethod CW

Misc Info : diisopropyl ethylphosphonate



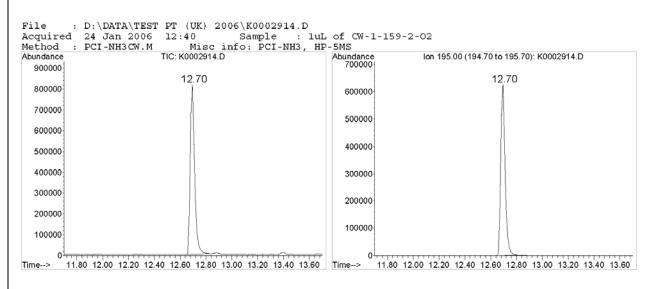
EI mass spectra of:

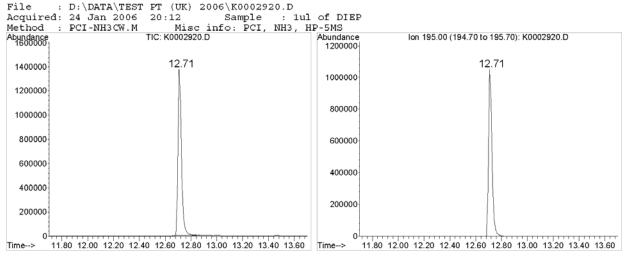
Compound 4 in Organic sample O2/05, aliquot CW-1-159-2-O2 Top:

Bottom: Authentic reference standard of Diisopropyl ethylphosphonate corresponding to compound 4 (MW: 194)

### **GC-CI-MS TECHNIQUE** METHOD AND ANALYSIS DESCRIPTION

Laboratory code: <u>05</u> S	ample code(s):	<u>O2</u>	<u>2/05</u>	Chem	ical numbe	r: <u>4</u>
Aliquot codes:						
Sample: CW-1-159-2-O2						
ANALYSIS METHOD						
Instrument Manufacturer	Agilent 6890/59	973 (	GC/MSD			
and Type:						
Carrier gas:	⊠ He □ N		$\square$ H <sub>2</sub>	Other:		
Flow rate:	☐ ml/min ⊠ 32 cm/s					
Flow control:	☐ Constant Pro	essur	re 🖂	Constant F	low	
Injection mode:	$\square$ Split $\rightarrow$ Split ratio = $\square$ On Column				olumn	
	$\boxtimes$ Splitless $\rightarrow$ Splitless time = 0.75 min.					
Injector temperature:	250 °C					
Column brand/phase:	Agilent HP-5M	S: (5	%-Phenyl	)-methylpo	lysiloxane	
Column Length x ID x	30 m x 0.25 mm	1 x 0.	.25 μm			
Film thickness:						
GC temperature	40 °C (3 min), 8	3 °C/	min, 300 °	<sup>o</sup> C (3 min)		
programme:						
Reaction gas:	☐ Methane		obutane	⊠ Ammo	nia 🗌 Otl	her:
Solvent delay time:	3 min		Scan ran	ge:	55-600 m/s	Z
Electron energy:	235 eV		Scan time	e:	0.7 s	
Ionisation polarity:			Mass res	olution:	0.7 u	
	☐ Negative					
Comments:						
IDENTIFICATION						
Compound identified as:			compound			
		•	ester deriva			
			•		l) derivative	
		•	•	yl) derivati	ve	
			rivative:			
Retention parameter used for			n time (Rt	)		
(peak) identification:	∐ Scai	n nur	nber			
			Own Sy		☐ Comme	rcial
☐ Not compared to reference				ım are expl		
chemical or library spectru	ım: LRT C	GC/MS	S-EI	∐ RT GC	/MS-CI	
Comments:						





CI chromatograms supporting identification of compound 4; TIC on left; EIC (m/z 195) on right.

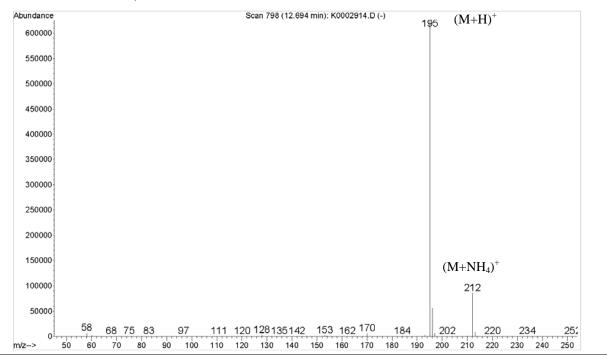
Top: Chromatograms of Organic sample, aliquot CW-1-159-2-O2 from O2/05, retention time 12.70

min.

Bottom: Chromatograms of authentic reference standard of **Diisopropyl ethylphosphonate**, retention time **12.71** min.

File :D:\DATA\TEST PT (UK) 2006\K0002914.D
Acquired : 24 Jan 2006 12:40 using AcqMethod PCI-NH3CW.M
Sample Name: 1uL of CW-1-159-2-O2

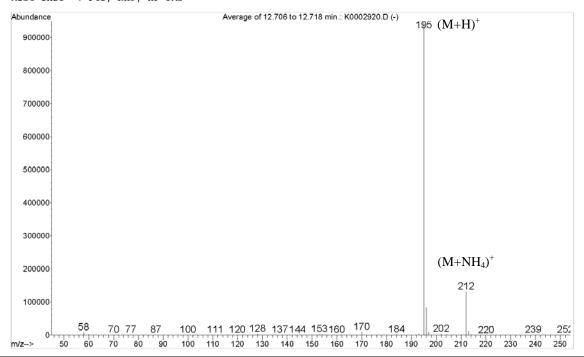
Misc Info : PCI-NH3, HP-5MS



File :D:\DATA\TEST PT (UK) 2006\K0002920.D

Acquired : 24 Jan 2006 20:12 using AcqMethod PCI-NH3CW.M

Sample Name: 1ul of DIEP Misc Info : PCI, NH3, HP-5MS



CI mass spectrum of:

Top: Compound 4 in Organic sample O2/05, aliquot CW-1-159-2-O2

Bottom: Authentic reference standard of **Diisopropyl ethylphosphonate** corresponding to compound **4** (MW: **194**)

# GAS CHROMATOGRAPHY TECHNIQUE METHOD AND ANALYSIS DESCRIPTION

Laboratory code: <u>05</u> S	Sample code(s):	O2/05	Chemical number: 4					
Aliquot codes:								
Sample: CW-1-159-2-O2	2							
<u> </u>								
ANALYSIS METHOD								
Instrument Manufacturer	Agilent 6890 G	C dual FPD						
and Type:								
Carrier gas:	$\square$ He $\square$ N <sub>2</sub> $\square$ H <sub>2</sub> $\square$ Other:							
Flow rate:	ml/m		32 cm/s					
Flow control:	Constant Pre		Constant Flow					
Injection mode:	$\square$ Split $\rightarrow$ Split ratio =							
	$\boxtimes$ Splitless $\rightarrow$ Splitless time = 0.75 min.							
Injector temperature:	250 °C							
Column brand/phase:	Agilent HP-5MS: (5%-Phenyl)-methylpolysiloxane							
Column Length x ID x	30 m x 0.25 mm x 0.25 μm							
Film thickness:								
GC temperature	40 °C (3 min), 8 °C/min, 300 °C (3 min)							
programme:								
<b>Detector:</b>	$\square$ AED $\rightarrow$	Element(	$(\mathbf{s}) =$					
	☐ NPD							
	$\boxtimes$ FPD $\rightarrow$	⊠ P-moo	de S-mode					
	Other:							
Comments:								
IDENTIFICATION								
Chemical identified as:	□ Original Che	mical						
Chemical identified as.	☐ Methyl ester							
			elsilyl) derivative					
	☐ TMS (Trimer		• •					
	Other derivation		1vative					
D. d. d.	_		7.0 1					
Retention parameter used	☐ Retention tin	ne (Rt)	Scan number					
for (peak) identification:	G 07 0	<u> </u>	70 0 1 1 5 5 6 1 1					
<b>⊠</b> Compared to reference	Source of Refer	ence:	☐ Own Synthesis ☐ Commercial					
chemical:	107.0	11 .10 10						
Compared to library	Measured RI of	identified C						
RI:	RI OCAD =	$\rightarrow$	OCAD Code =					
Comments								

**OPCW** Page no. 43 File : C:\DATA\TESTPT-1\FPD-0105.D
Acquired : 1/23/06 4:42:39 FM
Method name: CW.M
Sample Name: CW-1-159-2-02
Misc Info : OPCW sample FPD1 A, (C:\DATA\TESTPT~1\FPD-0105.D) 150 pA Compound: 4 13,040 30000 Sample: O2/0525000 Aliquot: CW-1-159-2-O2 Ret. time: 13.04 min. 20000 15000 GC/dFPD (phosphorous trace only) chromatogram of 10000 Organic sample. 5000 13.25 12.75 13.5 13.475 File : C:\DATA\TESTPT~1\FPD-0109.D
Acquired : 1/24/06 3:15:33 FM
Method name: CW.M
Sample Name: CW-CK-1-146-3
Misc Info : diisopropyl ethylphosphonate FPD1 A, (C:\DATA\TESTPT~1\FPD-0109.D) Compound: 4 150 pA 40000 13.041 Sample: reference std. 35000 Ret. time: 13.04 min. 30000 25000 GC/dFPD (phosphorous trace only) chromatogram of 20000 authentic reference standard 15000 Diisopropyl 10000 ethylphosphonate. 5000 12.5 13.25 12.25 12.75 13 13.5 13.75

min

#### **COMMENTS**

1. General
No relevant CWC schedule compounds were identified in sample O3/05
2 Cananda manananatian
2. Sample preparation  None
None
3. Analysis
No additional comments

#### 4. Report

The field length in the Chemstation software often did not allow for the full chemical name and may be truncated or abbreviated.

The GC Chemstation report software often truncated the time axis at approximately 80% of full scale; in no case was data of significance not displayed correctly.